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(54) Printed circuit bridge initiator for an air bag inflator

Brückenzünder mit gedruckten Leiterplatten für Airbag-Aufblasgeräte

Amorce détonateur à pont sur plaques à circuits imprimés pour un gonfleur d'un sac gonflable

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- **RESEARCH DISCLOSURE vol. AUGUST, no. 328 , 1991 , EMSWORTH GB pages 637 - 638 XP217963 ANONYMOUS 'techniques for fabricating electronic detonators'**

EP 0 609 605 B1

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Description

This invention relates to electrically initiable squibs or initiators for firing inflators for safety air bags in automotive vehicles.

A typical initiator for firing inflators for safety air bags in automotive vehicles has a fine gauge bridge embedded in a pyrotechnic material that ignites or fires when brought to a sufficiently high temperature. Such initiators are disclosed in US-A-3,572,247 to T. Warshall and in US-A-4,306,499 to W. W. Holmes. Heating of the bridge is effected by passing therethrough a direct electrical current. The energy required to attain the firing temperature is very small.

EP-A-0 520 360 on which disclosure the preamble of independent claim 1 is based, discloses an electronic detonator incorporating an energy dissipating device comprising a bridge having a pair of integral conductors, formed as part of an integrated circuit on a non-conductive substrate.

US-A-2,086,531 discloses an electric blasting detonator wherein a pair of conductors leading to a bridge are encapsulated in an insulating material within a metal shell. To prevent inadvertent firing by static electricity, one of the conductors is provided with a lateral projection or elbow contacting the inner wall of the shell to dissipate such charges.

The present invention consists in a bridge for an initiator of an air bag inflator comprising an elongated electrically nonconducting plastics substrate, and a pair of spaced electrically conducting strips extending for substantially the full length of the substrate and retained in position thereby, said strips being adapted for the connection thereto at respective first ends thereof of a source of direct electrical current and having a bridge connected therebetween at respective second ends thereof, characterised in that said conducting strips are in the form of a printed circuit on said substrate, said substrate being in the form of a thin film, and in that said second ends forming the bridge include respective opposed electrically conducting segments each of which is in the shape of a square with a pointed corner of one segment in electrical contacting relation with a pointed corner of the other segment.

The initiator of the invention may be fabricated by simpler methods of manufacture and is more adapted to being mass produced.

The deposited electrically conductive bridge is in intimate contact with the film whereby the initiator is especially resistant to damage tending to be caused by vibration, bending and handling.

A further advantage of the invention is that the bridge can be tuned by adjusting the width and/or thickness of the substrate, and the shape of the bridge segments.

The invention also provides an inflator for an air bag comprising a housing having a base component with a slot formed therein into the interior of said inflator, said slot having opposed walls, an initiator for said inflator including a printed circuit bridge as defined above, a portion at least of said initiator, including the bridge, being insertable into the interior of said inflator through said slot.

There can thus be provided an initiator for an air bag inflator that requires only a very small feed through slot into the interior of the inflator whereby if there is a structural initiator failure, the slot will be plugged with the larger products of combustion produced in the inflator, thereby minimizing the emission, if any, of the inflator combustion gases through the slot.

The initiator of the invention incorporates a printed circuit bridge including a thin base plate or substrate made of insulating or electrically nonconducting material such as polyamid. The printed circuit may be deposited on the substrate using conventional printed circuit techniques and may be made of metal such as copper, aluminum, tungsten and platinum. Additionally, in accordance with the invention, the printed circuit bridge may be made with, or without, a printed protrusion providing a spark initiation site to protect the initiator against the effects of electrostatic discharge. Also, the printed circuit bridge may incorporate in physical association with the bridge a printed or painted on explosive charge thereon, or such charge may be omitted, if desired.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of the specification. For a better understanding of the invention, its operating advantages, and specific objects attained by its use, reference is made to the accompanying drawings and descriptive matter in which a preferred embodiment of the invention is illustrated.

With this description of the invention, a detailed description follows with reference being made to the accompanying figures of drawings which form part of the specification, in which like parts are designated by the same reference numbers, and of which:

Fig. 1 is a front view, partly in cross section, showing the printed circuit bridge for an air bag initiator, according to one embodiment of the invention extending into the interior of an inflator through a slot in the base component thereof;
Fig. 2 is a front view, on a larger scale, of another embodiment of the printed circuit bridge according to the invention;
Fig. 3 is a fragmented side view, partly in cross section, illustrating a printed circuit bridge shown in Fig. 2 extending through a slot in the base of an inflator into a cavity therein comprising the ignition chamber and containing pyrotechnic material;
Fig. 4 is a fragmented front view, partly in section, of the invention embodiment shown in Fig. 3; and
Fig. 5 is a fragmented view illustrating the use of an electrically nonconducting film bonded to the surface of a printed circuit bridge to encase and there-

by preclude electrical contact with the wall of a slot in the base component of an inflator in which the bridge is to be inserted.

As used herein, the term "tuneability" means adjustment of the relationship between the magnitude of the direct electrical current flow through the initiator and the duration (time) of such current flow required to activate the initiator.

Referring to the drawings, there is shown in Fig. 1 a printed circuit bridge initiator 10 according to the invention comprising a thin elongated base plate or substrate 12 made of electrically insulating or nonconducting material such as polyamid. Provided on the surface 14 of the substrate 10 is a printed circuit bridge 16 that may be made of metal such as copper, aluminum, tungsten or platinum. The printed circuit bridge 16 may be deposited on the substrate 12 using conventional printed circuit methods and includes input terminals 17 and 19 and spaced electrically conducting strips 18 and 20. A shaped bridge 22 in an initiating region 23 of the bridge 16 joins the distal ends of the strips 18 and 20. The input terminals 17 and 19 are suitably adapted in known manner for connection to a source of direct electrical current (not shown).

The shaped bridge 22 is in the form of two generally equilateral squares 22a and 22b, as seen in the drawing, that are positioned in contiguous relation with a corner portion of one square touching a corner portion of the other, thereby providing a necked down or narrowed portion between them, as shown.

A printed or painted explosive charge of pyrotechnic material 24 may be provided in association with the shaped bridge 22 in the ignition region 23.

A protrusion 25 provided on strip 18 provides a spark initiation site to protect against electrostatic discharges that otherwise might fire the initiator 10.

In Fig. 1 the initiator 10 is shown positioned in association with an air bag inflator 26. Inflator 26, which may be of the solid fuel type, includes a housing 27 having a wall 28 provided with outer orifices 29, and includes a base component 30 in which a slot 32 that extends into the interior of the inflator is formed, in which slot initiator 10 is positioned. By way of example only and not limitation, it is noted that the inflator 26 may be of the type illustrated in U. S. patent No. 4,943,086 issued on July 24, 1990 to Donald J. Cunningham, which patent is assigned to the assignee of the present invention.

The printed circuit bridge initiator 10 heats up when the proper firing direct electrical current is passed through the bridge initiating region 23. The arrangement is such that it will not fire if the current is less than a specific magnitude or level, irrespective of the duration of the current flow. Once the initiating region 23 gets sufficiently hot, however, it ignites the printed or painted on explosive charge 24. The charge 24 ignites an initiator output charge (not shown in Fig. 1) which, in turn, ignites the solid fuel (not shown) within the air bag inflator 26.

The protrusion 25 on strip 18 provides the shortest distance between the printed circuit bridge 10 and a wall 34 of the slot 32 in the base component 30 of the inflator 26 to direct a spark such that the initiating region 23 is not damaged by the electrostatic discharge, nor operation of the inflator 26 initiated.

There is illustrated in Fig. 2 an elongated printed circuit bridge 36 that is formed on a plate or substrate 38 made of a material such as polyamid. At a first end 40 thereof the substrate 38 is substantially wider than at a second end 42 thereof. This allows the use at the end 40 of the substrate 38 of wider segments 44 and 46 of deposited metal for facilitating connection to a source of electrical current for activating the bridge 36. Provided at the other end 42 of the substrate 38 are two opposed segments 48 and 50 of deposited metal each of which segments are in the shape of a square and are disposed with respect to each other such that a pointed edge of one segment 48 is in touching, that is, electrical contacting relation with a painted edge of the other segment 50, as shown.

Extending between the segments 44 and 46 at the first end 40 of the substrate 38 and the segments 48 and 50 at the second end 42 thereof are first and second strips 52 and 54, respectively, the strips 52 and 54 being spaced from each other. Each of the strips 52 and 54, as shown, is substantially narrower than the segments 44 and 46 and also the segments 48 and 50.

A protrusion 55 is provided at an intermediate position along one of the strips, for example, strip 52, as shown, to provide a spark initiation site and thereby guard against the deleterious effects of electrostatic discharges.

In Fig. 2 pyrotechnic material is not shown printed or painted on the surface of the substrate 38 in association with the segments 48 and 50 in the initiator region. It will be understood, however, that if so desired, pyrotechnic material may be so provided thereat.

In the embodiment of the invention illustrated in Figs. 3 and 4, a printed circuit bridge 36 which may be similar to that illustrated in Fig. 2, is shown inserted through an opening 56 in the base component 58 of an inflator 60. The opening 56 includes a relatively large cutaway portion 62 adjacent the external surface of the inflator base component 58 and a narrow portion or slot 64 in an intermediate region of the base component 58, which slot 64 leads to an inner cavity 66 in the base component 58. The dimensions of the slot 64 in the side view as seen in Fig. 3 are just sufficient to allow the printed circuit bridge 36 to be inserted comfortably therethrough without scraping and damaging the bridge. Contained within the cavity 66, which is closed by a foil seal 68, is pyrotechnic material 70 in powder form which, for example, may be zirconium potassium perchlorate although other known pyrotechnic materials may also be employed.

In order to guard against contact or grounding be-

tween the strips 52 and 54 of the printed circuit bridge 36 and the adjacent wall 72 of the inflator base component 58, an epoxy seal 74 may be placed between the wall 72 and the metal forming the strips 52 and 54 of the bridge 36. Such an epoxy seal 74 may be formed either on the surface of the wall 72 or on the surface of the substrate 38, the latter being shown in Fig. 3. In each case the bridge strips 52 and 54 are electrically insulated from the wall 72. Alternatively, a thin film 76 of electrically nonconductive material such as polyamid may be bonded to the surface of the printed circuit bridge 36 thereby encasing the strips 52 and 54 therein, as illustrated in Fig. 5.

In accordance with the invention, the relatively large cutaway portion 62 adjacent the external surface of the inflator base component 58 is closed by seal means 78 which may comprise epoxy or molded seal or any other suitable sealing means, with an enlargement 80 internally of the cutaway portion 62 being provided to ensure retention of the seal means 78 therein.

As best seen in Fig. 4, a pyrotechnic material 82 is provided on the printed circuit bridge, at the initiator region 84 thereof which is located at the second end 42 of the substrate 38, being printed or painted thereon. The pyrotechnic material may be composed of lead styphnate or any other suitable pyrotechnic material.

A coating 86 of Nichrome, as shown in Fig. 4, may be applied by conventional electrostatic and other appropriate means to the metallic elements forming the segments 48, 50, 52 and 54 of the printed circuit bridge to avoid interaction, that possibly could be deleterious, between such metallic elements and the pyrotechnic material with which those elements come into contact.

Protection against electrostatic effects is provided by a pair of protrusions 88 and 90 that are provided in association with the elongated leg 54 and extends to the edge of the substrate 38. It will be noted that the ends of the protrusions 88 and 90 remain exposed even though the thin film 76, as shown in Fig. 5, electrically insulates the legs 52 and 54 from the wall 72 of the slot 64 in the base component 58 of the inflator 60. Thus, the thin film 76 does not interfere with the protrusions 88 and 90 providing spark protection against extraneous electrostatic effects.

In accordance with the invention, adjustment of the relationship between the magnitude of the direct electrical current flow through the printed circuit bridge of each of the embodiments herein illustrated and disclosed and the duration of such current flow that is required to activate, that is, fire the initiator may be effected by varying the thickness and width of the substrate and also by trimming, that is, varying the thickness and shape of the bridge that is printed or deposited on the substrate. Such trimming may be effected by conventional laser means to get an accurate fire/no fire condition.

As those skilled in the art will understand, the printed circuit bridge provides the following advantages over initiators currently used for air bag inflators.

1. The ability to change the width and the thickness of the bridge and the shape of the bridge allows tuning of the improved initiator. The initiators known in the prior art allow only a change in the type employed and the diameter thereof whereby they have limited fire/no fire tuneability.
2. In the prior art initiators, the glass-to-metal seal headers that are employed require lapping operations to create a flat surface for bridge attachment. The bridge is spot welded in place. The printed bridge replaces this complicated and expensive operation with a simple printed or disposition and etch operation.
3. The printed circuit bridge could improve reliability due to its process simplicity.

Thus, there has been disclosed, in accordance with the invention, an improved initiator for an air bag inflator that may be fabricated by simpler methods of manufacture and is more adapted to being mass produced. The improved initiator is characterized in comprising an electrically conductive bridge that is deposited on an electrically nonconductive thin film plastic substrate of compact size in intimate contact therewith whereby the structure is resistant to damage tending to be caused by vibration, bending and handling. The improved initiator is further characterized in the ability to effect tuning thereof by adjustment of the width and/or thickness of the substrate and also the shape of the bridge. Another feature of the improved initiator is the requirement thereof for only a very small feed through slot into the interior of the inflator in consequence of which, if there should be a structural failure of the initiator, the slot will be plugged by the larger products of combustion produced in the inflator. Additionally, the inflator housing is strengthened because there is required only a slot of relatively small cross section for inserting the improved initiator into the interior of the inflator.

By way of illustration and not limitation, it is contemplated that the printed circuit bridge initiator illustrated in Fig. 2 may have dimensions indicated, as follows:

a thickness in the range of 0.05 to 0.005 mm (.002 to .020 inches);
length of about 25 mm (1 inch);
length of first end portion 40 of 4.6mm (0.180 inch);
width at first end portion 40 of 6.4mm (0.252 inch);
width at second end portion 42 of 2.8mm (0.110 inch);
width of each of segments 44 and 46 of 1.3mm (0.07 inch);
length of each of segments 44 and 46 of 3.3mm (0.130 inch);
distance from first end portion 40 to projection of 6mm (0.235 inch).

Claims

1. A bridge (16) for an initiator (10) of an air bag inflator (26) comprising,

an elongated electrically nonconducting plastics substrate (12), and a pair of spaced electrically conducting strips (18, 20) extending for substantially the full length of the substrate and retained in position thereby, said strips being adapted for the connection thereto at respective first ends (17, 19) thereof of a source of direct electrical current and having a bridge (22) connected therebetween at respective second ends thereof,

characterised in that said conducting strips are in the form of a printed circuit on said substrate, said substrate being in the form of a thin film, and in that said second ends forming the bridge include respective opposed electrically conducting segments (22a, 22b) each of which is in the shape of a square with a pointed corner of one segment in electrical contacting relation with a pointed corner of the other segment.

2. A bridge as claimed in claim 1 wherein said substrate is made of polyamide.

3. A bridge as claimed in claim 1 or claim 2 wherein said spaced electrically conducting strips (18, 20) are made of metal.

4. A bridge as claimed in claim 3 wherein said metal is copper.

5. A bridge as claimed in claim 3 wherein said metal is tungsten.

6. A bridge as claimed in claim 3 wherein said metal is platinum.

7. A bridge as claimed in any one of claims 3 to 6 wherein said metal is plated with nicrome (86).

8. A bridge as claimed in any one of claims 3 to 7 wherein said printed circuit bridge is printed on said substrate (12).

9. A bridge as claimed in any one of claims 3 to 7 wherein said printed circuit bridge is formed on said substrate (12) by a conventional printed circuit technique.

10. A bridge as claimed in any preceding claim wherein a pyrotechnic material (24) is provided at the second end of the substrate (12), adjacent to and in contact with the bridge.

11. An inflator (26) for an air bag comprising:

a housing (27) having a base component (30) with a slot (32) formed therein into the interior of said inflator, said slot having opposed walls, and

an initiator (10) including a printed circuit bridge (16) as claimed in any preceding claim, a portion at least of said initiator, including the bridge, being insertable into the interior of said inflator through said slot.

12. An inflator for an air bag as claimed in claim 11 further including at least one protrusion (25) formed on one of said electrically conducting strips (18, 20) and extending toward an adjacent edge of said substrate (12) whereby said protrusion provides the shortest distance between the printed circuit and a wall of said slot (32) in said base component of said inflator to direct a spark such that said bridge is not damaged by electrostatic discharge.

13. An inflator as claimed in claim 11 or claim 12,

wherein a cavity (66) is formed in said base component (58) of said inflator interiorly thereof, said cavity being in communication with said slot (64), and further including pyrotechnic material (70) within said cavity.

14. An inflator as claimed in claim 13 wherein said bridge portion at least of said printed circuit bridge extends into said pyrotechnic material in said cavity in said base component of said inflator.

15. An inflator as claimed in any one of claims 11 to 14 further including seal means (78) for sealing said printed circuit bridge in the slot (64) in the base component (58) of said inflator.

16. An inflator as claimed in any one of claims 11 to 15 further including means (74, 76) for electrically insulating said spaced electrically conducting strips and said bridge from an adjacent wall of the slot when said printed circuit bridge is inserted therein.

Patentansprüche

1. Brücke (16) für einen Zünder (10) einer Airbag-Aufblaseinrichtung (26) mit

einem länglichen, elektrisch nichtleitenden Kunststoffunterteil (12) und einem Paar voneinander beabstandeter, elektrisch leitender Streifen (18, 20), die sich im wesentlichen über die volle Länge des Unterteils erstrecken und dabei in ihrer Stellung gehalten werden, wobei diese Streifen für ihre Verbindung an jeweiligen ersten Enden (17, 19) desselben mit einer elektrischen Gleichstromquelle ausgebildet sind und eine an jeweiligen zweiten Enden

derselben dazwischen verbundene Brücke (22) haben, **dadurch gekennzeichn t**, daß die leitenden Streifen in der Form einer gedruckten Schaltung auf dem Unterteil vorliegen, wobei das Unterteil die Form eines dünnen Filmes hat, und daß die die Brücke bildenden zweiten Enden jeweils einander gegenüberliegende elektrisch leitende Segmente (22a, 22b) einschließen, von denen jedes in der Form eines Rechtecks mit einer spitzen Ecke eines Segmentes in elektrischer Kontaktbeziehung mit einer spitzen Ecke des anderen Segmentes vorliegt.

2. Brücke nach Anspruch 1, bei der das Unterteil aus Polyamid besteht.

3. Brücke nach Anspruch 1 oder Anspruch 2, bei der die voneinander beabstandeten elektrisch leitenden Streifen (18, 20) aus Metall bestehen.

4. Brücke nach Anspruch 3, bei der das Metall Kupfer ist.

5. Brücke nach Anspruch 3, bei der das Metall Wolfram ist.

6. Brücke nach Anspruch 3, bei der das Metall Platin ist.

7. Brücke nach einem der Ansprüche 3 bis 6, bei der das Metall mit Nicrom (86) plattiert ist.

8. Brücke nach einem der Ansprüche 3 bis 7, bei der die gedruckte Schaltungsbrücke auf dem Unterteil (12) aufgedruckt ist.

9. Brücke nach einem der Ansprüche 3 bis 7, bei der die gedruckte Schaltungsbrücke auf dem Unterteil (12) mit Hilfe einer herkömmlichen Methode zur Herstellung einer gedruckten Schaltung ausgebildet ist.

10. Brücke nach einem der vorausgehenden Ansprüche, bei der ein pyrotechnisches Material (24) an dem zweiten Ende des Unterteils (12) in Nachbarschaft zu und in Berührung mit der Brücke vorgesehen ist.

11. Aufblaseinrichtung (26) für einen Airbag mit

einem Gehäuse (27) mit einem Basisteil (30) mit einem darin ausgebildeten Schlitz (32) in das Innere der Aufblaseinrichtung, wobei dieser Schlitz einander gegenüberliegende Wände hat, und

einem Zünder (10) mit einer gedruckten Schaltungsbrücke (16) nach einem der vorausgehenden Ansprüche, wobei ein Abschnitt wenigstens des Zünders einschließlich der Brücke in das Innere der Aufblaseinrichtung durch den Schlitz einsetzbar ist.

12. Aufblaseinrichtung für einen Airbag nach Anspruch 11 weiterhin mit wenigstens einem Vorsprung (25), der auf einem der elektrisch leitenden Streifen (18, 20) ausgebildet ist und sich zu einer benachbarten Kante des Unterteils (12) erstreckt, wodurch dieser Vorsprung den kürzesten Abstand zwischen der gedruckten Schaltung und einer Wand des Schlitzes (32) in dem Basisteil der Aufblaseinrichtung ergibt, um einen Funken derart auszurichten, daß die Brücke nicht durch elektrostatische Entladung zerstört wird.

13. Aufblaseinrichtung nach Anspruch 11 oder Anspruch 12, bei der ein Hohlraum (66) in dem Basisteil (58) der Aufblaseinrichtung in deren Innerem ausgebildet ist, wobei dieser Hohlraum in Verbindung mit dem Schlitz (64) steht und weiterhin pyrotechnisches Material (70) in dem Hohlraum einschließt.

14. Aufblaseinrichtung nach Anspruch 13, in welcher der Brückenabschnitt wenigstens der gedruckten Schaltungsbrücke sich in das pyrotechnische Material in dem Hohlraum in dem Basisteil der Aufblaseinrichtung erstreckt.

15. Aufblaseinrichtung nach einem der Ansprüche 11 bis 14 weiterhin mit einer Abdichtungseinrichtung (78) zum Abdichten der gedruckten Schaltungsbrücke in dem Schlitz (64) in dem Basisteil (58) der Aufblaseinrichtung.

16. Aufblaseinrichtung nach einem der Ansprüche 11 bis 15 weiterhin mit einer Einrichtung (74, 76) zum elektrischen Isolieren der voneinander beabstandeten elektrisch leitenden Streifen und der Brücke gegenüber einer benachbarten Wand des Schlitzes, wenn die gedruckte Schaltungsbrücke darin eingesetzt ist.

Revendications

1. Pont (16) destiné à une amorce (10) d'un organe (26) de gonflage d'un coussin gonflable, comprenant :

un substrat allongé et non conducteur de l'électricité (12) formé d'une matière plastique, et deux bandes distantes (18, 20) conductrices de l'électricité, s'étendant pratiquement sur toute la longueur du substrat et maintenues en position par celui-ci, les bandes étant destinées à être connectées, par des premières extrémités respectives (17, 19), à une source d'un courant électrique continu et

ayant un pont (22) connecté entre elles à des secondes extrémités respectives,

caractérisé en ce que les bandes conductrices sont sous forme d'un circuit imprimé formé sur le substrat, le substrat étant sous forme d'un film mince, et en ce que les secondes extrémités formant le pont ont des segments opposés respectifs (22a, 22b) conducteurs de l'électricité ayant chacun la forme d'un carré, un coin pointu d'un segment étant en contact électrique avec un coin pointu de l'autre segment.

2. Pont selon la revendication 1, dans lequel le substrat est formé d'un polyamide.

3. Pont selon la revendication 1 ou 2, dans lequel les bandes distantes et conductrices de l'électricité (18, 20) sont formées d'un métal.

4. Pont selon la revendication 3, dans lequel le métal est le cuivre.

5. Pont selon la revendication 3, dans lequel le métal est le tungstène.

6. Pont selon la revendication 3, dans lequel le métal est le platine.

7. Pont selon l'une quelconque des revendications 3 à 6, dans lequel le métal est revêtu de "Nichrome" (86).

8. Pont selon l'une quelconque des revendications 3 à 7, dans lequel le pont de circuit imprimé est imprimé sur le substrat (12).

9. Pont selon l'une quelconque des revendications 3 à 7, dans lequel le pont de circuit imprimé est formé sur le substrat (12) par une technique classique de fabrication de circuit imprimé.

10. Pont selon l'une quelconque des revendications précédentes, dans lequel une matière pyrotechnique (24) est placée à la seconde extrémité du substrat (12) près du pont et au contact de celui-ci.

11. Dispositif de gonflage (26) de coussin gonflable, comprenant :

un boîtier (27) ayant un élément de base (30) dans lequel est formée une fente (32) à l'intérieur du dispositif de gonflage, la fente ayant des parois opposées, et
une amorce (10) comprenant un pont (16) de circuit imprimé selon l'une quelconque des revendications précédentes, une partie au moins de l'amorce, comprenant le pont, étant destinée à être introduite à l'intérieur du dispositif de gonflable par la fente.

12. Dispositif de gonflage de coussin gonflable selon la revendication 11, comprenant en outre au moins une saillie (25) formée sur l'une des bandes conductrices de l'électricité (18, 20) et tournée vers un bord adjacent du substrat (12), si bien que la saillie forme la plus courte distance entre le circuit imprimé et une paroi de la fente (32) dans l'élément de base de l'organe de gonflage afin qu'une étincelle soit dirigée d'une manière telle que le pont n'est pas détérioré par une décharge électrostatique.

13. Dispositif de gonflage selon la revendication 11 ou 12, dans lequel une cavité (66) est formée dans l'élément de base (58) du dispositif de gonflage à l'intérieur de celui-ci, la cavité communiquant avec la fente (64), et comprenant en outre un matériau pyrotechnique (70) à l'intérieur de la cavité.

14. Dispositif de gonflage selon la revendication 13, dans lequel la partie de pont du pont de circuit imprimé au moins pénètre dans le matériau pyrotechnique placé dans la cavité de l'élément de base du dispositif de gonflage.

15. Dispositif de gonflage selon l'une quelconque des revendications 11 à 14, comprenant en outre un dispositif (78) de scellement du pont de circuit imprimé dans la fente (64) de l'élément de base (58) du dispositif de gonflage.

16. Dispositif de gonflage selon l'une quelconque des revendications 11 à 15, comprenant en outre un dispositif (74, 76) destiné à isoler électriquement les bandes distantes conductrices de l'électricité et le pont d'une paroi adjacente de la fente lorsque le pont de circuit imprimé est inséré dans celle-ci.

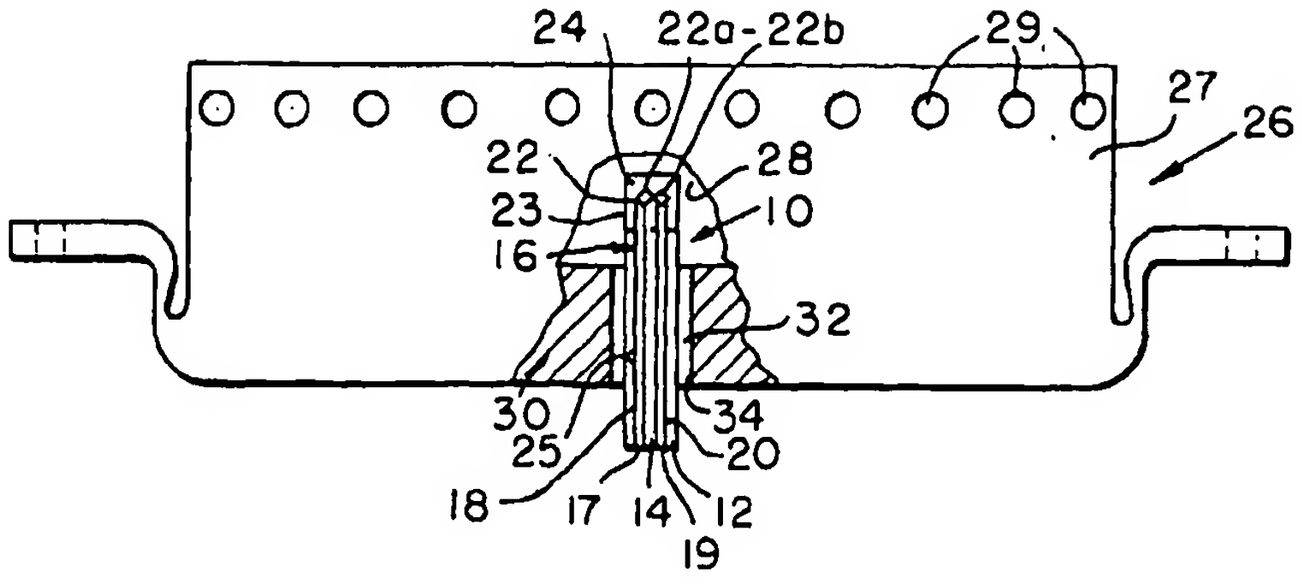


FIG. 1

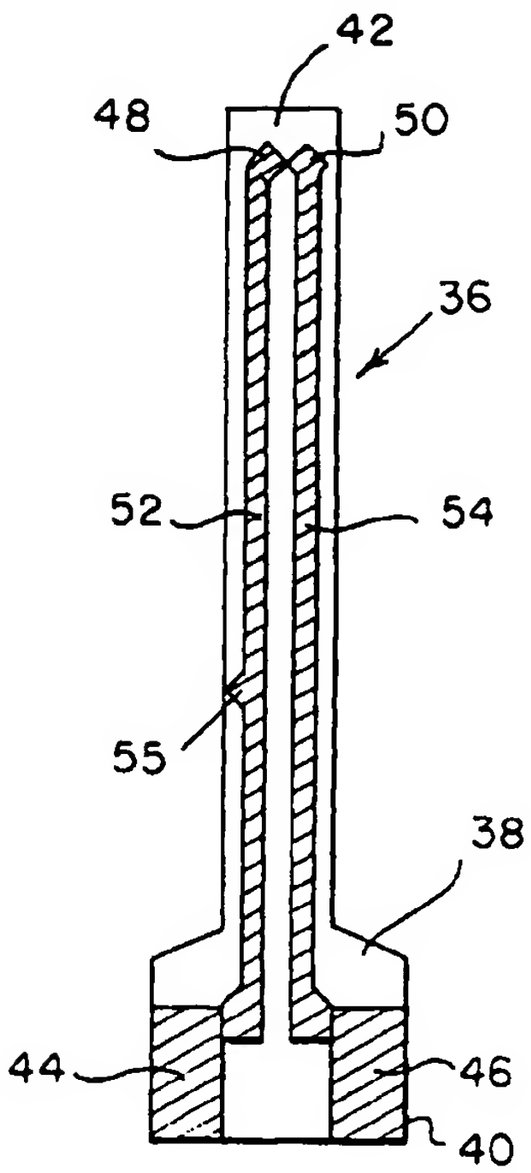


FIG. 2

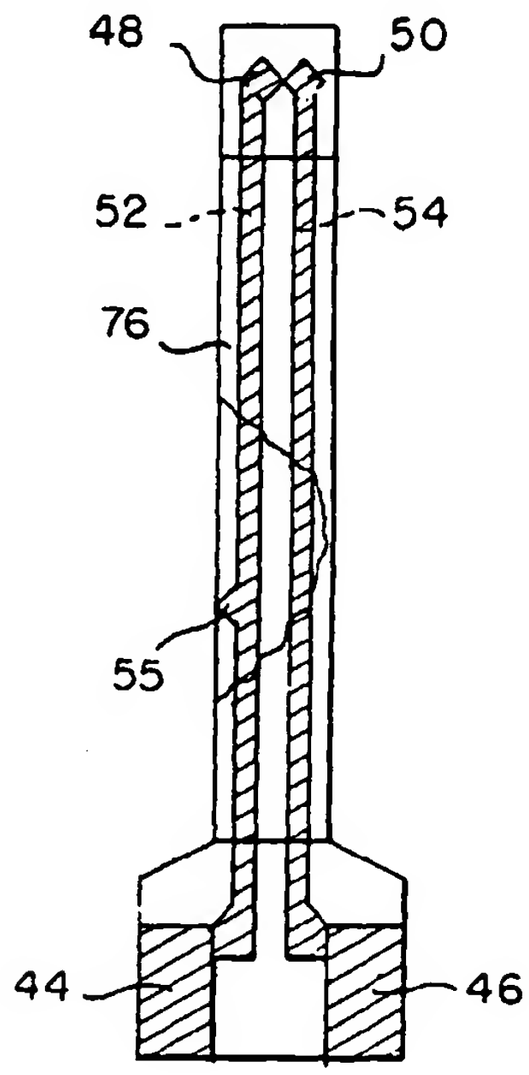
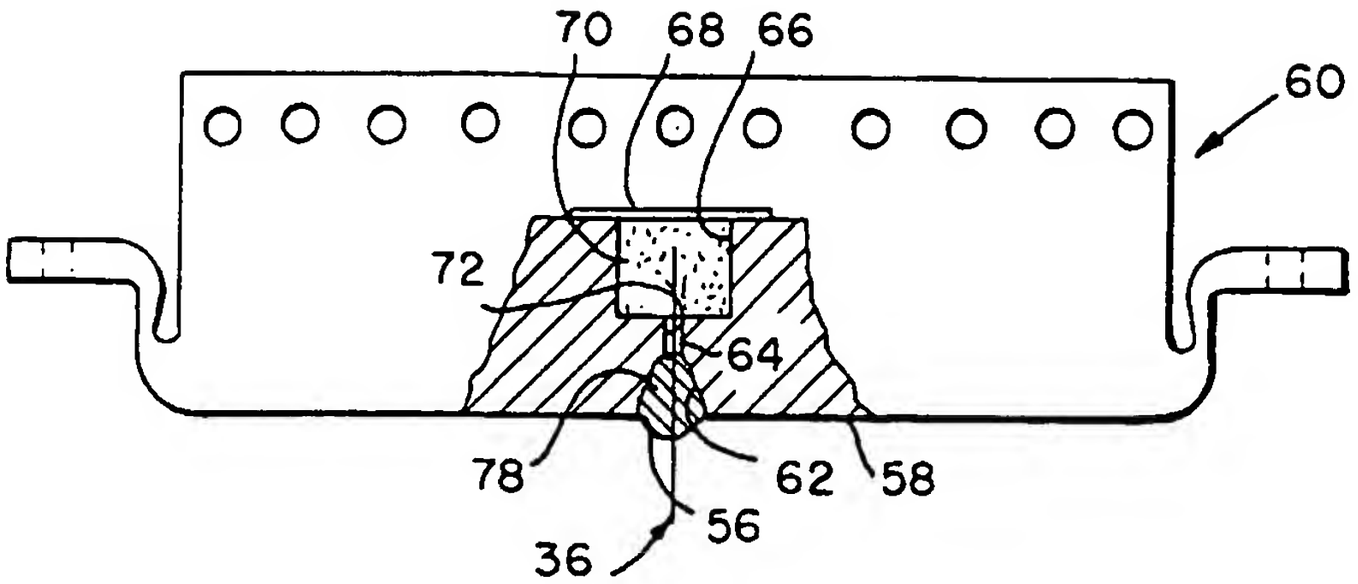


FIG. 5

FIG. 3


70
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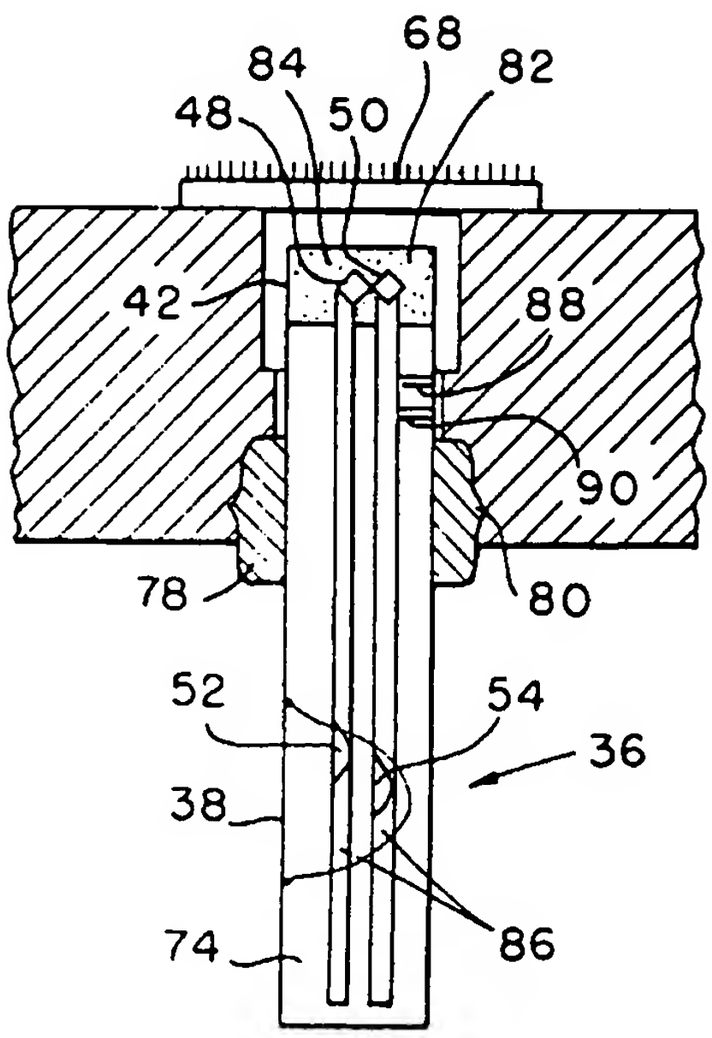
60
72
64
78
62
58
56
36


84
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82
48
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42
88
90
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80
52
54
36
38
74
86

FIG. 4